A new species of *Eutarsopolipus* Berlese (Acari: Podapolipidae) from *Agonum sexpunctatum* (L.) (Coleoptera: Carabidae) from Germany and notes on the *biunguis*-group of *Eutarsopolipus*

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(With 9 figures)

**Abstract**

*Eutarsopolipus brevici* n. sp. (Acari: Podapolipidae) is described from *Agonum sexpunctatum* (Coleoptera: Carabidae) from three localities in Germany and compared with related *Eutarsopolipus* in the *biunguis*-group of *Eutarsopolipus*. Figures of previously undescribed instars of *Eutarsopolipus* species in the *biunguis*-group, synonymy of *Eutarsopolipus* species, keys to species, new host and locality records and comments on the *biunguis*-group are presented.

**Introduction**

Mites in the family Podapolipidae (Acari: Tarsonomini) are all highly specialized ecto- and endoparasites of insects of the orders Blattaria, Orthoptera, Heteroptera, Hymenoptera and especially Coleoptera. All mites in the genus *Eutarsopolipus* Berlese, 1913 are ectoparasites of carabid beetles.

Hans Regenfuss, pioneer in the study of the Podapolipidae, died in 1979 leaving unfinished projects, including undescribed taxa of *Eutarsopolipus*. The Regenfuss Collection was acquired by Gisela Rack for the Zoological Museum, University of Hamburg, Germany in 1985. An examination of mites in the Regenfuss Collection yielded a new *Eutarsopolipus* species in the *biunguis*-group.

The purpose of this paper is to describe a new *Eutarsopolipus* species from the carabid beetle *Agonum sexpunctatum* (L.), collected in three localities in Germany. Moreover, the paper redescribes and illustrates instars of three species described by Regenfuss, eliminates *nomina nuda*, provides a key to eight species in the *biunguis*-group within *Eutarsopolipus* as modified from Regenfuss (1968) and presents new host, locality records and comment on that species complex.

**Materials and Methods**

Measurements were taken with the aid of a ZEISS phase contrast microscope with a drawing tube and stage micrometer. All measurements are in micrometers (μm). Setae no longer than
Figs 1-3. *Eutarsopolipus brevici* n. sp.: 1 - adult female, dorsal aspect; 2 - adult female, propodosoma; 3 - male, ventral and dorsal aspects.
the diameter of their setal sockets are listed as microsetae (m). Often long setae are obscured, bent, broken or at an angle which makes measurement difficult. Setae are at least as long as indicated. Terminology is based on Lindquist (1986).

Type material is deposited in the Zoological Museum Hamburg (ZMH) and in the collection of the senior author, Adrian (RWH).

**Systematics**

Family Podapolipidae Ewing, 1922
Genus Eutarsopolipus Berlese, 1913

*Eutarsopolipus brevici* sp. n.  
(Figs 1-4)

*Eutarsopolipus oblongus*: Regenfuss 1972 (p. 46, 50; *nomen nudum*).

**DIAGNOSIS:** Adult females of *E. brevici* sp. n. are distinguished from other members of the *biunguis*-group by lateral bulges at the level of plate *D*, divided plate *C*, undivided plates *D* and *EF*, by narrower plates *C* than those in its closest relative, i.e. *E. agonobius* Regenfuss, 1968 and shorter, spikelike setae *pl* and *u* on tarsi II, III (Table 1).


**ETYMOLOGY.** *E. brevici* sp. n. is named for a narrow plate *C* in the adult female.


Idiosoma: length 400-430, width 240-300. Prodorsal plate wider than long, setae *v*₁ (m), *v*₂ 3-4, *sc*₂ 35. Setae *v*₂ lateral to a line connecting *v*₁ and *sc*₂. Plate *C* divided, distance between plates *C* 62-107, plate *C* width 43-63, setae *c*₁ (m), *c*₂ (m)-6; plate *D* width 109-123, seta *d* 3-4. Plate *EF* width 78-85, seta *e* 5. Plate *H* width 40, setae *h*₁, *h*₂ (m).

Venter with apodemes 1 moderately developed, meeting sternal apodeme medially. Coxal setae 1a, 2a (m), 3a 5, 3b 7. Distance between setae 3a and 3b 13.

Legs: Leg setation as in Table 2. Ambulacrum I, II, III without claws. Femur I seta *d* (m). Tarsus I solenidion *ω* 3. Tibia I solenidion ♂ 4, seta *d* 24, tibia II seta *d* 5, tibia III seta *d* 5-6.

**MALE** (Fig. 3). Gnathosoma: length 27-28, width 26-29. Cheliceral stylet length 15-17, palp length 12, pharynx width 8, dorsal gnathosomal seta 5, ventral seta (m), distance between ventral setae 14.
Figs 4-5. *Eutarsopolipus brevici* n. sp.: 4 - larval female, ventral and dorsal aspects; *Eutarsopolipus biunguis* Regenfuss: 5 - larval female, ventral and dorsal aspects.
Idiosoma: length 125-145, width 70-100. Prodorsal plate setae \( v_1 \), \( v_2 \) (m), \( sc_2 \) 19. Setae \( c_1 \), \( c_2 \), \( d \) (m). Venter with apodemes 1 and 2 moderately developed. Coxal setae 1a, 2a, 3a, 3b (m).

Legs: leg setation as in Table 2. Ambulacrum I with one claw, length 5, ambulacra II, III without claws. Tarsus I solenidion \( \omega \) (m). Tibia I solenidion \( \varphi \) 3. Tibia I seta \( d \) 10, tibia II seta \( d \) 3, tibia III setae \( d \) 5. Femur I setae \( d \) (m). Genital capsule length 45, width 35, with concave lateral margins.

**LARVAL FEMALE** (Fig. 4). Gnathosoma: length 38, width 38. Cheliceral stylet length 26, pharynx width 10. Palp length 15; dorsal gnathosomal seta 12, ventral seta (m).

Idiosoma: length 188, width 153, setae \( v_1 \) \( v_2 \) (m), \( sc_2 \) 50. Distance between setae \( v_1 \) 13; distance between setae \( sc_2 \) 62. Setae \( c_1 \), \( c_2 \), \( d \), \( e \) (m). Venter with apodemes 1 and 2 weakly developed. Coxal setae 1a, 2a (m); 3a 8, 3b 4-5. Distance between setae 3a and 3b 20. Setae \( h_1 \) 166, \( h_2 \) 60. Distance between setae \( h_1 \) 8.

Legs: Setation pattern as in the male. Ambulacrum I with small claws, 5; ambulacra II, III without claws. Femur I seta \( d \) (m). Tarsus I solenidion \( u \) 3. Tibia I solenidion \( c \) \( p \) 4, seta \( k \) 3. Tibia I seta \( d \) 35, tibia II, III setae \( d \) 6.

Larval female and male of *E. biunguis*, *E. globosus* and *E. agonobius* were not illustrated by Regenfuss (1968) and males and larval females of *E. globosus* and *E. agonobius* were not described. Redescriptions of larval and adult females of the species above and descriptions of males and larval females of *E. globosus* and *E. agonobius* are presented for comparison with new and existing species.

*Eutarsopolipus biunguis* Regenfuss, 1968

(Fig. 5)


Idiosoma: length 330-378, width 310-360. Prodorsal plate wider than long, setae \( v_1 \) 3-9, \( v_2 \) 7-20, \( sc_1 \) vestigial, \( sc_2 \) 40-45. Setae \( v_2 \) lateral to a line connecting \( v_1 \) and \( sc_2 \). Plate C not divided, width 220-225, setae \( c_1 \) 6-10, \( c_2 \) 7-10; plate \( D \) width 150-152, seta \( d \) 7. Plate \( EF \) width 110-140, seta \( e \) 7. Coxal setae 1a (m), 2a (m), 3a 4-6, 3b 4-7. Distance between setae 3a and 3b 23.

Legs: leg setation as in Table 2. Ambulacrum I without claws, ambulacra II, III claws 3-4. Femur I seta \( l \) 4-5, seta \( d \) (m). Tarsus I solenidion \( \omega \) 3. Tibia I solenidion \( \varphi \) 3-5, seta \( d \) 20, tibia II seta \( d \) 6, tibia III seta \( d \) 6-8.

**LARVAL FEMALE** (Fig. 5). Gnathosoma: length 30-34, width 36-37. Cheliceral stylet length 24-28, pharynx width 8. Palp length 12; dorsal gnathosomal seta 15, ventral seta (m).

Idiosoma: length 170-230, width 150-183, setae \( v_1 \), \( v_2 \) (m), \( sc_2 \) 45. Distance between setae \( v_1 \) 32; distance between setae \( sc_2 \) 49. Setae \( c_1 \) 5, \( c_2 \) (m), \( d \) 3, \( e \) (m).
Venter with apodemes 1 and 2 weakly developed. Coxal setae 1a, 2a (m); 3a 6, 3b 9. Distance between setae 3a and 3b 24. Setae h1 77, h2 30. Distance between setae h1 7.

Legs: setation pattern as in adult female. Ambulacrum I with small claws 5; ambulacra II, III claws minute, 2-3. Femur I seta d (m). Tarsus I solenidion ω (m). Tibia I solenidion φ 4, seta k (m). Tibia I seta d 20, tibia II setae d 6, tibia III setae d 7.

New distribution records of *E. biunguis*, all collected by H. Regenfuss, are: Dechsendorf, Germany, 29 August 1963, 30 August 1963, 31 March 1964 and one female and larva with no date or locality, all from *Agonum viduum* (Panzer, 1797).

*Eutarsopolipus globosus* Regenfuss, 1968
(Figs 6, 7)

*Eutarsopolipus irregularis*: Regenfuss 1972 (p. 46, 60; nomen nudum).


Idiosoma: length 280, width 279. Prodorsal plate wider than long, setae v1, 5, v2 9, sc2 25. Setae v2 lateral to a line connecting v1 and sc2. Plate C divided, plate C width 58-65, setae c1 thick 4, c2 thick 3; plate D width 47-52, seta d 5. Plate EF width 71, seta e 7. Plate H length 20, width 34, setae h1, h2 m. Coxal setae 1a (m)-3, 2a (m)-5, 3a (m)-10, 3b (m)-7. Distance between setae 3a and 3b 23.


MALE (Fig. 6). Gnathosoma: length 32, width 31. Cheliceral stylet length 19, pharynx width 8, dorsal gnathosomal seta 8, ventral seta (m).

Idiosoma: length 162, width 110. Prodorsal plate setae v1, v2 (m), sc1 vestigial, sc2 13. Setae c1, c2, d, e (m). Venter with apodemes 1 and 2 weakly developed. Coxal setae 1a, 2a, 3a, 3b (m).

Legs: leg setation as in Table 2. Ambulacrum I with one claw, length 4, ambulacra II, III without claws. Tarsus I solenidion ω (m). Tibia I solenidion φ 3. Tibia I seta d 11, tibia II seta d 7, tibia III setae d 6. Femur I setae d (m). Genital capsule length 26, width 25 at base, with concave lateral margins.

LARVAL FEMALE (Fig. 7). Gnathosoma: length 32, width 35. Cheliceral stylet length 25, pharynx width 9. Palp length 12; dorsal gnathosomal seta 16, ventral seta 5.

Idiosoma: length 210, width 216, setae v1, v2 (m), sc2 48. Distance between setae v1 21; distance between setae sc2 62. Setae c1, c2, d, e (m). Venter with apodemes 1 and 2 weakly developed. Coxal setae 1a, 2a (m); 3a 8, 3b (m). Distance between setae 3a and 3b 29. Setae h1 160, h2 30. Distance between setae h1 8.
Legs: setation pattern as in the male. Ambulacrum I with small claws, 5; ambulacra II, III without claws. Femur I seta \( d \) (m). Tarsus I solenidion \( \omega \) 3. Tibia I solenidion \( \varphi \) 5, seta \( k \) (m). Tibia I seta \( d \) 30, tibia II seta \( d \) 18, III setae \( d \) 34.

New host and distribution records of *E. globosus*, all collected by H. Regenfuss, are: Rheinweiler, 9 June 1969 and Wyhl, 2 July 1971, from *Agonum marginatum* (L.); Rheinweiler, 9 June 1969 from *Agonum muelleri* (Herbst, 1785); Kleinkems, 19 May 1968, Rheinweiler, 26 April 1969 and 10 June 1969 from *Paranchus albipes* (Fabricius, 1796) (all in Germany).

*Eutarsopolipus agonobius* Regenfuss, 1968
(Figs 8, 9)


I d i o s o m a: length 300-360, width 190-240. Prodorsal plate wider than long, setae \( v_1 \) (m), \( v_2 \) 5, \( sc_2 \) 34. Setae \( v_2 \) lateral to a line connecting \( v_1 \) and \( sc_2 \). Plate C divided, width 110, setae \( c_1 \) 3, \( c_2 \) 9; plate \( D \) width 144, seta \( d \) 4. Plate \( EF \) width 92, seta \( e \) 5. Coxal setae \( 1a \) 4, \( 2a \) 4, \( 3a \) 10, \( 3b \) 7. Distance between setae \( 3a \) and \( 3b \) 40.

Legs: leg setation as in Table 2. Ambulacra I, II, III without claws. Femur I seta \( d \) (m). Tarsus I solenidion \( \omega \) 4. Tibia I solenidion \( \varphi \) 4, seta \( d \) 20, tibia II seta \( d \) 15, tibia III seta \( d \) 8.

Male (Fig. 8). Gnathosoma: length 30, width 33. Cheliceral stylet length 17-20, pharynx width 10, dorsal gnathosomal seta 3, ventral seta (m).

I d i o s o m a: length 162, width 123. Prodorsal plate setae \( v_1 \), \( v_2 \) (m), \( sc_2 \) 20-30. Setae \( c_1 \), \( c_2 \), \( d \) (m). Venter with apodemes 1 and 2 moderately developed. Coxal setae \( 1a \) 3, \( 2a \) (m); \( 3a \) 9, \( 3b \) 5. Distance between setae \( 3a \) and \( 3b \) 22. Setae \( h_1 \) 150, \( h_2 \) 45. Distance between setae \( h_1 \) 7.

LARVAL FEMALE (Fig. 9). Gnathosoma: length 35, width 38. Cheliceral stylet length 25, pharynx width 10. Palp length 10; dorsal gnathosomal seta 13, ventral seta 3.

I d i o s o m a: length 232, width 202, setae \( v_1 \), \( v_2 \) (m), \( sc_2 \) 48. Distance between setae \( v_1 \) 21. Setae \( c_1 \) (m), \( c_2 \), \( d \), \( e \) 3. Venter with apodemes 1 and 2 weakly developed. Coxal setae \( 1a \) 3, \( 2a \) (m); \( 3a \) 9, \( 3b \) 5. Distance between setae \( 3a \) and \( 3b \) 22. Setae \( h_1 \) 150, \( h_2 \) 45. Distance between setae \( h_1 \) 7.

Legs: setation pattern as in the male. Ambulacrum I with small claws, 5; ambulacra II, III without claws. Femur I seta \( d \) (m). Tarsus I solenidion \( \omega \) 3. Tibia I solenidion \( \varphi \) 4, seta \( k \) (m). Tibia I seta \( d \) 32, tibiae II, III setae \( d \) 5.
New distribution records for *E. agonobius* are: Gottenheim, 20 June 1971, 1 July 1971 and Veldensteiner Forst, 22 June 1971, from *A. sexpunctatum*.

Table 1. Maximum measurements of *Eutarsopolipus* in the biunguis-group: *E. biunguis* (= bingu.), *E. globosus* (globo.), *E. agonobius* (agono.), *E. trichognathi* (trich.), *E. lindquisti* (lindq.), *E. elzingai* (elzin.), *E. platyni* (platy.) and *E. brevici* sp. n. (brevi). (D = divided plate C or D).

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*From Regenfuss 1968.*
Discussion

Regenfuss (1968) described the biunguis-group of Eutarsopolipus to include the following species: E. biunguis, E. globosus and E. agonobius. Species added to this group since 1968 are: E. trichognathi Husband and Eidelberg, 1996, E. lindquisti Husband, 1998a, E. elzingai Husband, 1998b, E. platyni Husband and Husband, 2002 and the one species described herein.

Neither the female holotype or a paratype of E. biunguis have ambulacrum I claws but both have small (3-4) ambulacra II, III and claws in contrast to no claws in the other seven species. Characters for the biunguis-group as conceived by Regenfuss (1968) are: in adult females, setae v', v'' developed, epimer III present, setae c2 present, ambulacral II, III without claws (true for all but E. biunguis), ambulacrum I without a claw, genu III without a seta, trachea and stigma present, tibia/tarsus I separate, cheliceral stylets in forward part of gnathosoma, three idiosomal tergites, femur I seta l' small or not present, larval female trochanter I without a flap, setae h, not widely separated and with plate EF narrower than plate D, male with genital capsule about as long as the width of the base, conical and with sides concave.

Eutarsopolipus species which are parasites of beetles in the carabid genus Agonum are all members of the biunguis-group of Eutarsopolipus except Eutarsopolipus sp. from Agonum chathamii Van Dyke, 1953, collected in the Galapagos Islands. Adult females of this species have well developed ambulacral I, II, III claws in contrast to no ambulacral I claws in the biunguis-group. E. lukoschusi Husband, 1986 could be considered in the biunguis-group as adult females have no or very small ambulacral I claws and no ambulacral II, III claws. Both Eutarsopolipus sp. from the Galapagos Islands and E. lukoschusi have femur I seta v'' well developed in contrast to this seta not present in the biunguis-group. We conclude that these two species do not belong in this species complex.

Table 2. Leg setation for femora (F), genua (G), tibiae (Ti), tarsi (Ta) for adult females of Eutarsopolipus biunguis, E. globosus, E. agonobius, E. trichognathi, E. lindquisti, E. elzingai, E. platyni and E. brevici sp. n. (Femur I seta l' and tibia I seta k are difficult to see. They are included if they are not microsetae. Tarsus I seta u'' is only clear in E. platyni).

<table>
<thead>
<tr>
<th>Species in biunguis-group</th>
<th>Leg I</th>
<th>Leg II</th>
<th>Leg III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>G</td>
<td>Ti</td>
</tr>
<tr>
<td>E. biunguis</td>
<td>2</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>E. globosus</td>
<td>1</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>E. agonobius</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>E. trichognathi</td>
<td>2</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>E. lindquisti</td>
<td>1</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>E. elzingai</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>E. platyni</td>
<td>2</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>E. brevici sp. n.</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>
Regenfuss (1972) discusses the concept of microhabitats as related to adult female podapolipid mites on carabids. Idiosomal shapes and cheliceral stylet lengths of adult female mites are related to spaces occupied on host species. Different species of parasitic mites occupy different spaces on carabid hosts. Thus, it is logical that different host beetles should have different species of podapolipid mite parasites. In most cases, this appears to be true. Regenfuss (1968) also noted that adult females of the myzus-group of *Eutarsopolipus* may be distinguished by shape but larvae and males are very similar and are difficult to separate. We found the same difficulty with species in the *biunguis*-group.

**Key to adult females of *biunguis*-group in *Eutarsopolipus***

1. Plate C entire ................................................................. 2 
   - Plate C divided ............................................................... 5

2. Without small ambulacral II, III claws ........................................ 3 
   With small ambulacral II, III claws ............................................. *E. biunguis*

3. Femur I seta I’ vestigial or not present ..................................... 4 
   - Femur I seta I’ conspicuous (3-4) ......................................... *E. trichognathi*

4. Idiosomal setae c₁, d, e longer (12, 10, 8) .................................. *E. lindquisti*
   - Idiosomal setae c₁, d, e shorter (6, 5, 3) ............................... *E. elzingai*

5. Plate D entire ............................................................................. 6 
   - Plate D divided .................................................................... *E. globosus*

6. Cheliceral stylets shorter than 45 (32-40) .................................... 7 
   - Cheliceral stylets 45 or longer (48) ........................................ *E. platyni*

7. Tarsii III setae pl’, u’ long (12), plate C wider (110) .................. *E. agonobius*
   - Tarsii III setae pl’, u’ short (7), plate C narrower (50-70) .......... *E. brevici* *sp. n.*

**Zusammenfassung**


**References**


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